Original Article

Progressive rehabilitation of the sprained ankle: A novel treatment method

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ABSTRACT

Objectives: This randomised, single blinded cohort study was designed to assess the immediate effect of manual fascial manipulation on walking pain and the range of ankle dorsiflexion within the first 4 days after ankle trauma.

Methods: Measurements were taken from 19 subjects, 5 female and 14 male, who presented with grade I–III ankle sprains. Ankle dorsiflexion was photographed in a standardised position and calculated by means of the Dartfish® Advanced Video Analysis Software and SPSS® (version 17) was used to compare the pre- and post-treatment data.

Results: After one treatment session 13 of the 19 subjects were walking pain free and 3 of the 19 were walking with only little pain. The highly significant (p < 0.001) mean improvement of ankle dorsiflexion was 7.9° (± 5.8°). All, apart from one subject, whom were walking pain free after treatment showed a minimum of 4° increased dorsiflexion.

Conclusion: Early fascia work around the injured ankle improves ankle dorsiflexion and reduces walking pain. It may reduce the delay of tissue healing and, thus, optimise further rehabilitation of the sprained ankle which may also reduce socio-economic costs.

1. Introduction

Ankle sprains, although regarded as a minor injury, seem to be very common. The 2011 update of Clinical Evidence, published by the BMJ group, states that one in 10,000 people sprain their ankle each day with ankle sprains accounting for ¼ of all sports injuries [1]. So, across the European Union with an estimated population of almost 513.5 million [2], over 50,000 people will suffer from ankle sprains each day. Early mobilisation and wearing an external support improve function and stability of the ankle compared with minimal treatment or immobilisation [1,3–5]. The aim of progressive rehabilitation therefore is to avoid sensorimotor and mechanical deconditioning due to immobilisation [1,3–5]. The aim of progressive rehabilitation therefore is to avoid sensorimotor and mechanical deconditioning due to immobilisation, optimise rehabilitation time, and also, last not least, reduce socio-economic costs including costs of medical care, sick leave, and the loss of productivity while patients are on sick leave.

Patients suffering from ankle sprains present with a grade I, II or III ankle injury, wherein grade I describes a minimal tear with no laxity to the ligaments involved, grade II describes mild to moderate laxity, and a complete disruption of ligaments is termed a grade III [1]. Grade III present with a limp due to painful restriction of ankle dorsiflexion. With respect to the injured tissue, the central theme of rehabilitation must be structured to the stages of wound healing. So, whilst it is not possible to load the injured tissue during inflammation phase in the first days after trauma, fascia manipulation may be possible on the surrounding connective tissues. The forces acting on the ankle joint during trauma will not only have torn the ligaments, but may have spread to the connective tissues, leaving a sprain pattern in the surrounding tissues. This connective tissue sprain seems to be the limiting factor for ankle dorsiflexion during walking.

The treatment applied during the early stages of rehabilitation follows the concept of the fascial distortion model (FDM) as described by Typaldos [6]. Three different fascial distortions are corrected: trigger-bands, continuum distortions, and folding distortions. Triggerbands are anatomical injuries to banded fascial tissues in which the fibres have become distorted. They are corrected along the painful triggerband pathway in the subcutaneous or inter-muscular fascial gliding areas with pressure applied using the thumb (Fig. 1). Thumb pressure is also applied to correct continuum distortions at the transition zone between ligament, tendon, or other fascial structure, and bone (Fig. 2). An axial traction high velocity thrust is applied to the tibiotalar joint to correct...
folding distortions of the ankle joint (Fig. 3). There is no given order for the application of the different techniques. Some of the techniques may need to be repeated in different areas around the ankle joint, and treatment progression follows the clinical findings of painful restriction of movement. While the effectiveness of these and other FDM correction techniques has been described for acute, nonspecific Low-Back Pain [7], the medial tibial stress syndrome [8], and frozen shoulder [9], a high-quality clinical trial is needed to investigate the effect of FDM correction techniques for the treatment of acute ankle sprains [10].

There is no difference in the treatment access to grade I–III, but obviously there is a difference in the progression of the rehabilitation process and the amount of external support. Further to the treatment, external support is adapted as needed. The patient is allowed to perform within pain free motion. Once the subject is able to perform sports without pain a tape bandage is used to protect the injured structure well into the remodelling phase (2–4 months).

So far, no research has been carried out to investigate the immediate effect on the dorsiflexion range of motion (ROM) of this treatment approach for the acute sprained ankle.

2. Materials and methods

In this randomised, single blinded cohort study a random sample of 19 subjects gave their consent for this treatment. Inclusion criteria where defined as one or more of the typical signs for ankle sprains: anterior instability, talar tilting, tenderness on palpation at the ligament insertions, and pain, heat, and swelling, as well as less function. Subjects with fractures defined by X-ray where excluded. All subjects where diagnosed by a Medical Doctor before referral. Most of them were seen on the 1st or 2nd day after trauma, some of them on the 3rd or 4th day. All subjects consented for their data to be disseminated.

Measurements before and after treatment where taken by means of a standardised lateral view photograph (Figs. 4 and 5). Two marks where drawn on the proximal and distal fibula for later reference. The subject stood sideways to a fixed platform with a defined distance of 2.20 m to the camera. Photographs of maximal pain free dorsiflexion where taken while the patient was pushing their knees forward. Photographs where then saved and imported into the Dartfish© Advanced Video Analysis Software, Fribourg, Switzerland. Dartfish© has been shown to be a highly valid two-dimensional video analysis software with high correlations to goniometric measures (Pearson $r ≥ 0.95$) and nonsignificant differences. Both intrarater and interrater reliability values of hip and knee flexion angles were excellent (ICC ≥ 0.91). ICCs for test-retest reliability were 0.79 and 0.91 for hip and knee flexion, respectively [11].

The ankle dorsiflexion angle was defined by the axial line of the fibular bone (defined by two markers, one on the fibular head and one on the lateral malleolus) and the line along the horizontal measurement platform on the medial side of the patient’s foot. The measurement results and the subjective statement on pain during walking of 19 patients (5 female/14 male, age $30 ± 9.5$ years) were transferred to a spreadsheet and the difference in ankle dorsiflexion was calculated.

SPSS® (version 17) was used to compare the pre- and post-treatment data. As the data were normal distribution (Skewness coefficient less than double their standard errors), the paired sample t-test was used to identify whether two sets of data were significantly different or not.
Significance level was set as 0.05.

3. Results

From the 19 subjects, 12 were seen within 2 days after trauma, 2 were seen 3 days after trauma and 4 were seen 4 days after trauma. Two subjects did not experience pain during normal walking, while 17/19 subjects presented with a painful limp. After treatment 13/19 subjects were walking pain free, whereas 3 subjects reported only little pain and showed no limp. Three subjects still showed a painful limp after treatment but two of them were walking pain free the following day. The one subject who reported painful walking up until after the third treatment session was only referred for treatment on day 7 after injury (Table 1).

The mean improvement of ankle dorsiflexion for the 19 subjects was 7.9° (± 5.8°). All, apart from one subject walking without pain after treatment, showed a minimum of 4° increased dorsiflexion. Two subjects did not show improvement of dorsiflexion after treatment with one of them (Table 1) walking pain free the day after treatment. The other subject was seen only 7 days after injury and did not show significant improvement in either pain or range of ankle movement after the first treatment session (Table 1).

There was no correlation between the amount of ankle ROM improvement and the reduction of pain. One subject with ankle ROM improvement of 25.2° still reported a little pain during normal walking after treatment while another subject walked pain free with only 1.4° improvement of ankle ROM (Table 1).

Using the paired t-test, it was found that the pre- and post-treatment data were significantly different (p < 0.001). Mean difference was 7.9° with a 95% confidence interval between 5 to 10°.

4. Discussion

The present study shows that soft tissue work surrounding the injured ligament in the sprained ankle improves ankle ROM and pain in most of the treated cases (84%) after only one treatment session within the first 4 days of rehabilitation. The remarkably reliable effect of the FDM treatment leaves most of the subjects presenting with a painful limp in the practice walking pain free after a 45-minute treatment session.

A highly significant average increase of 7.9° ankle dorsiflexion was shown to be effective in reducing pain during walking. However, as little as a 4° improvement of ankle dorsiflexion ROM may be sufficient to improve pain during normal walking and, thus, reduce pain avoidance behaviour and sensorimotor deconditioning.

From the results of one subject treated in this study (Table 1) it could be argued that increased immobilisation reduces the effect of soft tissue work and mobilisation, most probably due to the effect of increased build-up of cross-links in the surrounding connective tissues [12]. This would coincide with the authors’ practical experience that mobilisation becomes more difficult with a longer immobilisation time period during early rehabilitation.

The use of a video measurement system and a simple measurement setup allow valid data collection outside a controlled gait lab environment and enables researchers to take out clinical studies in settings where sophisticated computerised systems are unavailable.

5. Conclusion

In conclusion it may be stated that early fascia manipulation improves joint mobility and reduces walking pain. It may reduce the delay of tissue healing and, thus, optimise further rehabilitation of the sprained ankle which may also reduce socio-economic costs.

Table 1
Ankle dorsiflexion angle and subjective pain assessment before and after treatment.

<table>
<thead>
<tr>
<th>Pat ID</th>
<th>Gender</th>
<th>Age</th>
<th>Days after trauma</th>
<th>DF° before treatment</th>
<th>Walking pain before treatment?</th>
<th>DF° after treatment</th>
<th>Walking pain after treatment?</th>
<th>DF° difference</th>
</tr>
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<tr>
<td>p1</td>
<td>F</td>
<td>27</td>
<td>2</td>
<td>65.5</td>
<td>Yes</td>
<td>56.8</td>
<td>No</td>
<td>8.7</td>
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<tr>
<td>p2</td>
<td>F</td>
<td>51</td>
<td>0</td>
<td>64.3</td>
<td>Yes</td>
<td>52.7</td>
<td>No</td>
<td>11.6</td>
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<td>p3</td>
<td>F</td>
<td>20</td>
<td>1</td>
<td>69.9</td>
<td>Yes</td>
<td>56.0</td>
<td>No</td>
<td>13.9</td>
</tr>
<tr>
<td>p4</td>
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<td>26</td>
<td>2</td>
<td>53.8</td>
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<td>44.3</td>
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<td>M</td>
<td>23</td>
<td>2</td>
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<td>72.7</td>
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<td>F</td>
<td>30</td>
<td>4</td>
<td>67.3</td>
<td>Yes</td>
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<tr>
<td>p7</td>
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<td>30</td>
<td>1</td>
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<td>p8</td>
<td>M</td>
<td>32</td>
<td>2</td>
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<td>30</td>
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<td>2</td>
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<td>2</td>
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<td>No</td>
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<td>31</td>
<td>7</td>
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<td>56</td>
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<td>62.0</td>
<td>Yes, 1 day later no 4.2</td>
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<tr>
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<td>31</td>
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<td>66.9</td>
<td>Yes</td>
<td>66.8</td>
<td>Yes, 1 day later no (56,9) 0.1(10)</td>
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<td>3</td>
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<td>Little</td>
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</table>

* DF°: degree of ankle dorsiflexion.
Conflict of interest

All authors have no financial or personal relationships with other people or organisations that could inappropriately influence (bias) their work. The study was internally funded.

References